CLAIMS

1. A method for determining the concentration of a target analyte in a sample using multi-spectral analysis, comprising the steps of:

generating at least one basis set that includes at least one interfering component in said sample; and

applying a spectroscopic signal representative of said sample to said basis set;

wherein a component of said sample corresponding to said analyte is identified by application of said basis set.

2. The method of Claim 1, wherein said sample is serum; and wherein said basis set comprises interfering components that include any of water, temperature/hydrogen effects, bonding effects, albumin, globulin, protein, triglycerides, cholesterol, urea, scatter correction, refractive index correction, depth of penetration, and organic, body, and physical components.

3. The method of Claim 1, wherein said basis set does not include those components that do not interfere with detection of said analyte.

4. The method of Claim 1, further comprising the step of:
identifying all relevant interfering components.

5. The method of Claim 4, further comprising the step of:
determining how each of said interfering components interact.

6. The method of Claim 5, further comprising the step of:
extracting each of said interfering components.

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7. The method of Claim 6, further comprising the step of:

comparing spectra for each of said interfering components with that of each of said interfering components in solution.

8. The method of Claim 1, wherein a basis set is sequentially and iteratively generated for each of said interfering components.

~~9.~~ 10 The method of Claim 1, further comprising the steps of:

characterizing each of said interfering components in said sample; and

subtracting each of said interfering components from spectra produced at a frequency of interest.

~~10.~~ 9 The method of Claim 8, further comprising the step of:

combining said basis sets mathematically to generate a set of transforms that may be stored in a look-up table for use during analysis.

11. The method of Claim 1, further comprising the steps of:

applying said basis set to a first signal produced during said multi-spectral analysis to identify a second signal representative of said analyte;

applying multivariate analysis to said second signal.

12. The method of Claim 11, wherein said multivariate analysis comprises a partial least squares analysis, followed by a principal components analysis.

13. A method generating at least one basis set for application in determining the concentration of a target analyte in a sample using multi-spectral analysis, said method comprising the steps of:

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identifying at least one relevant interfering component of said sample at a same frequency as that of said analyte;

identifying said at least one relevant interfering component at other frequencies to quantify absorbance of said interfering components at said other frequencies; and

removing said at least one interfering component at said analyte frequency.

14. The method of Claim 13, wherein each step of said method is repeated for each of said at least one interfering component to produce a plurality of basis sets for an analyte.

15. The method of Claim 13, further comprising the step of:

determining the concentration of said target analyte in said sample with said basis set by:

collecting spectra data with a spectroscopic device;

converting said spectral data collected by said spectroscopic device to digital data;

operating upon such digital input data in accordance with various transforms stored in one or more look-up tables (LUTs), wherein said LUTs contain transforms that incorporate said basis set, and wherein said transforms use said basis set to identify and remove interfering constituents from the spectral signal produced by said spectroscopic device.

17 ~~16~~. The method of Claim 13, further comprising the step of:

storing said basis set in a lookup table.

18 ~~17.~~ The method of Claim 13, said basis set comprising:

a series of spectra of said analyte at different physiological concentrations of interest.

14 ~~18.~~ The method of Claim 15, wherein said basis set is applied before or in connection with a physical model that corrects for interfering physical factors that include any of scattering, pathlength, and temperature.

19. The method of Claim 13, further comprising the step of:

providing a plurality of basis sets that are used to quantify an analyte in a liquid sample.

20. The method of Claim 13, further comprising the step of:

selecting different pathlengths for each spectral window.

21. The method of Claim 20, wherein said pathlengths comprise:

about 1 mm for a combination band region;

about 2 to 8 mm for a first overtone region; and

about 10 mm or greater for a second overtone region.

22. The method of Claim 13, wherein one or more basis sets are applied to a spectroscopic signal during analysis to produce an accurate spectral representation from which analyte concentration may be accurately determined.

23. The method of Claim 13, wherein said basis set includes all interfering components found in said sample.

24. An apparatus for determining the concentration of a target analyte in a sample using multi-spectral analysis, comprising:

at least one basis set that includes at least one interfering component in said sample;

wherein a spectroscopic signal representative of said sample is applied to said basis set; and

wherein a component of said sample corresponding to said analyte is identified by application of said basis set.

25. The apparatus of Claim 24, wherein said sample is serum; and wherein said basis set comprises interfering components that include any of water, temperature/hydrogen effects, bonding effects, albumin, globulin, protein, triglycerides, cholesterol, urea, scatter correction, refractive index correction, depth of penetration, and organic, body, and physical components.

26. The apparatus of Claim 24, wherein said basis set does not include those components that do not interfere with detection of said analyte.

27. The apparatus of Claim 24, said basis set further comprising:

all relevant interfering components.

28. The apparatus of Claim 27, wherein said basis set is generated by determining how each of said interfering components interact.

29. The apparatus of Claim 28, wherein said basis set is further generated by extracting each of said interfering components.

30. The apparatus of Claim 29, wherein said basis set is further generated by comparing spectra for each of said interfering components with that of each of said interfering components in solution.

31. The apparatus of Claim 24, further comprising:
a basis set is for each of said interfering components.

33 ~~32.~~ The apparatus of Claim 24,wherein said basis set is generated by characterizing each of said interfering components in said sample; and subtracting each of said interfering components from spectra produced at a frequency of interest.

32 ~~33.~~ The apparatus of Claim 31, said basis set further comprising:
a mathematically generated set of transforms that may be stored in a look-up table for use during analysis.

34. The apparatus of Claim 24,wherein said basis set is applied to a signal produced during said multi-spectral analysis to identify a signal representative of said analyte; and wherein multivariate analysis is applied to said signal.

35. The apparatus of Claim 34, wherein said multivariate analysis comprises a partial least squares analysis, followed by a principal components analysis.

36. A basis set for application in determining the concentration of a target analyte in a sample using multi-spectral analysis, said basis set comprising:
spectral information representative of relevant interfering components of said sample at a same frequency as that of said analyte; and
spectral information representative of substantially all of said relevant interfering components at other frequencies to quantify absorbance of said interfering components at said other frequencies;
in which spectral information of said interfering components is removed from a sample spectra at said analyte frequency;

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said basis set being stored in a memory for use by a processor during multi-spectral analysis.

37. The apparatus of Claim 36, further comprising:

a plurality of basis sets for an analyte.

38. The apparatus of Claim 36, further comprising:

an instrument for determining the concentration of said target analyte in said sample with said basis set, said instrument comprising:

a spectroscopic device for collecting spectra data;

an analog-to-digital converter for converting said spectral data collected by said spectroscopic device to digital data;

a processor for operating upon such digital input data in accordance with various transforms stored in one or more look-up tables (LUTs), wherein said LUTs contain transforms that incorporate said basis set, and wherein said transforms use said basis set to identify and remove substantially all interfering constituents from the spectral signal produced by said spectroscopic device.

39. The apparatus of Claim 36, wherein said basis set is stored in a lookup table.

40. The apparatus of Claim 36, said basis set comprising:

a series of spectra of said analyte at different physiological concentrations of interest.

41. The apparatus of Claim 38, wherein said basis set is applied before or in connection with a physical model that corrects for interfering physical factors that include any of scattering, pathlength, and temperature.

42. The apparatus of Claim 36, further comprising:

a plurality of basis sets that are used to quantify an analyte in a liquid sample.

43. The apparatus of Claim 36, wherein different pathlengths are selected for each spectral window.

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44. The apparatus of Claim 43, wherein said pathlengths comprise:

about 1 mm for a combination band region;

about 5 to 10 mm for a first overtone region; and

about 10 mm or greater for a second overtone region.

45. The apparatus of Claim 36, wherein one or more basis sets are applied to a spectroscopic signal during analysis to produce an accurate spectral representation from which analyte concentration may be accurately determined.

46. The apparatus of Claim 36, wherein said basis set includes all interfering components found in said sample.

47. The apparatus of Claim 36, wherein said spectral information is non-invasively collected.